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THE COORDINATION
OF
LIGHT AND MUSIC

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THE COORDINATION *of* LIGHT AND MUSIC

by

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EDISON LAMP WORKS **NATIONAL LAMP WORKS**
GENERAL  ELECTRIC
COMPANY
Nela Park, Cleveland



The General Electric Lighting Institutes at Harrison and Cleveland welcome all visitors. A few minutes or a few hours will be found very interesting and instructive.

The Coordination of Light and Music

Most of the larger motion picture houses have color lighting installations which they use during the playing of the overture or musical interlude. Some have cove or cornice lighting in which colored lamps are concealed, and light from these is directed on the ceiling and walls; other houses employ large ornamental fixtures fitted with several circuits of colored lamps, and still others are able to flood a neutral tinted curtain with colored light from above, below, and the sides.

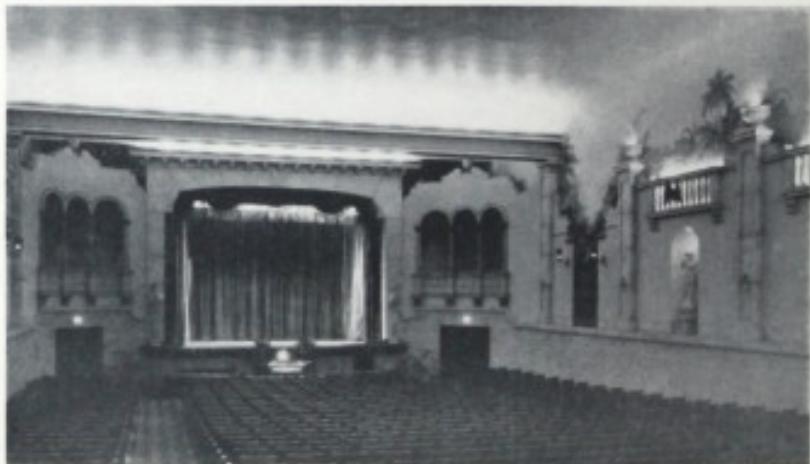
This changing colored lighting may be very pleasing to the audience or may be annoying to the artistic person. It can be pleasing to everyone and a thing of interest, joy, and thrill if proper coordination of color and music is attained. With ordinary methods of operation, however, the chance of obtaining really beautiful effects is remote.

To appreciate why bad effects are secured one should go back stage and watch the electrician manipulate switches and dimmers on the color circuits during the playing of the musical numbers. Except in a few outstanding instances where the management has set forth a very definite schedule which it insists on the operator following, the average

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electrician pays no attention whatever to the music as he manipulates the various circuits. His attitude seems to be somewhat as follows: "Here is a color lighting installation. It is paid for and in operation. I will show the audience that we have this and turn on red, green, blue, and yellow as my whim or fancy dictates."

If there is anything to the fact that two of our senses, hearing and seeing, can be affected at the same time to produce a desirable reaction; if there is any basis of the coordination of the psychological value of color and music—and those who have given the matter serious thought are convinced that there is a very definite tie-in—then by this hit or miss method of operation the chances of proper coordination are very slight indeed.



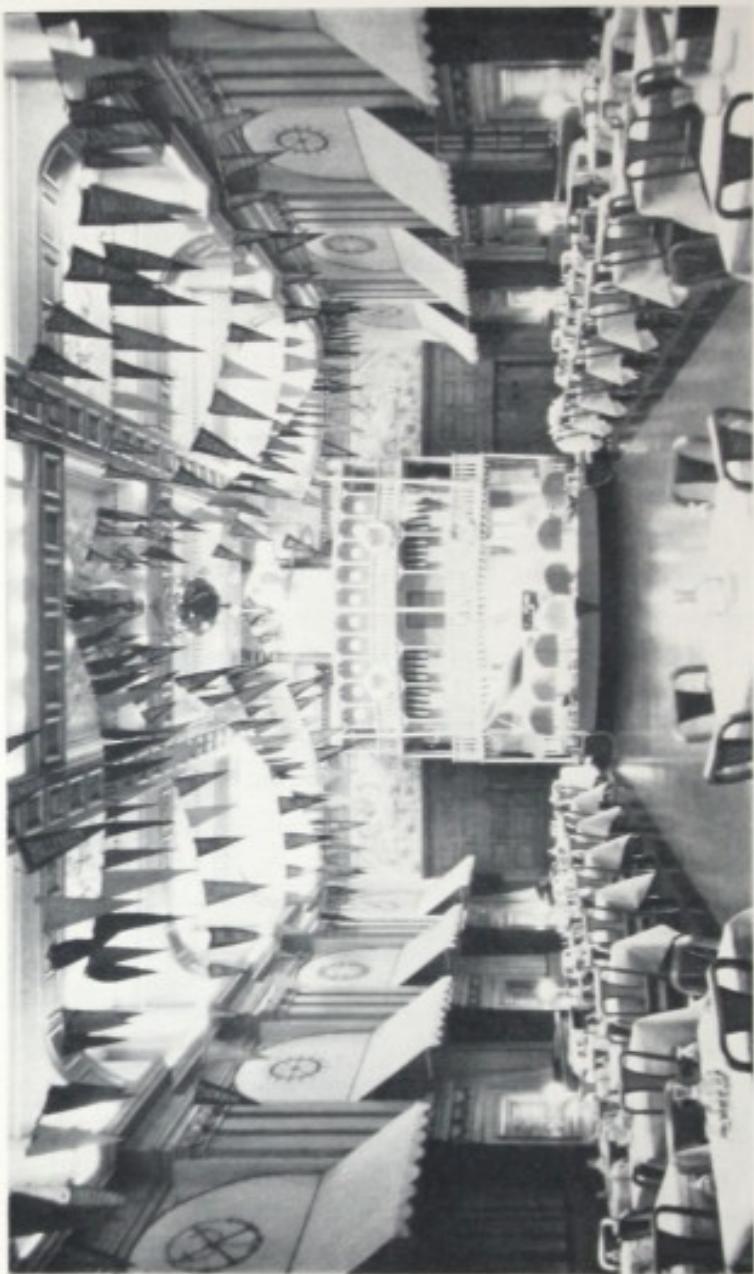
The ceiling of this theatre can be lighted with any color. By the use of carefully correlated programs, the audience will doubly appreciate the music because of its translation in flowing colors.

Possibilities for the Future

The time will come when control of the color lighting will be in the hands of a musician, or at least operated by someone who can follow a musical score, and for the best results the one who operates the lighting should be in such a position that he can see the actual color effects as the changes are made. The musical scores will have contained in them a schedule of color changes prepared jointly by a musician and psychologist.

The motion picture theatre is constantly striving to raise its programs to a higher level. It has a remarkable opportunity through this medium to educate the public in music appreciation and to make its offerings more attractive to the better class of patron. Proper coordination of color and music has a popular appeal. This is no mere theory but has been worked out in practice. At the G. E. Lighting Institute in Harrison, New Jersey, one of the features is a demonstration of "Color and Music." This has been shown to many thousands during the past five years and always creates interest. The most encouraging feature of this demonstration is the fact that, in general, the better the musical education of the listener, or the greater his degree of appreciation, the more outstanding is his reaction to the coordination. It can be safely said that there has never been an unfavorable comment from any observer who was well educated along musical lines.

The motion picture house which is the first in a community to make a feature of light and music stands to



The "Show Boat" at the Hollenden Hotel in Cleveland is an outstanding example of the use of mobile color lighting. A clever control device automatically plays predetermined color programs or it may be played upon as an organ to interpret the moods of the artist.

gain remarkable prestige. A proper presentation involves practically no expense, for in most instances the equipment is already installed. All that is required is its intelligent use and proper direction.

It is not strange that the coordination or joining of light and music has not been developed to a greater degree. Broadly speaking, appreciation of music itself is comparatively modern and it has been only during the last few years that adequate means of controlling and changing, of modifying, the light have been available. The future looks very bright. Within the last decade, several experimenters have been working on the combination of light and music, and more and more investigators are interesting themselves in the subject. Individually one can accomplish very little but, as pointed out above, when the motion picture theatres with their trained organizations take up the matter actively, the art should advance by leaps and bounds.

Early Experiments

Many attempts have been made to coordinate color and music. Some of these have been quite successful, others not entirely so because of certain assumptions the experimenters have made that are fundamentally incorrect, as will be pointed out later.

The first extensive attempt made in America along this line was at Carnegie Hall, eight or nine years ago. The Russian composer Scriabine had prepared the score of a number, with color accompaniment *Poem of Fire—Prometheus*.

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Being much more familiar with music than with light, he attempted to assign tonal values to the primary colors and tints. His conception of color was distinctly unscientific and the manuscript called for a number of indefinite colors, such as *misty pink, steel gray, pearl*, and the like. One, naturally, had great difficulty in interpreting what the composer had in mind. One instrument of his orchestra was what he termed "tastiera per luce" (light keyboard). At Carnegie Hall a box about five feet square with a white background was used on which colored light could be thrown and varied in intensity and tone (color). A score was written for this device and it was introduced at will, much as he would a part for the woodwinds or brass.



In a theatre of this nature, color lighting of the curtain, ceiling dome, lunettes, and side wall boxes can be very satisfactorily coordinated with the music.

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Sometimes, one color would be visible for quite a period, then there would be a rapid variation of tint. The box which was used was so small that the effect was lost at the rear of the hall and the effect of the color was lost in competition with the huge orchestra.

This device was also used in connection with the symphonic fragment *The Enchanted Lake* by Liadoff a year later, but neither attempt could be classed as highly successful. To get the maximum impression of color there must be a relatively large light colored area on which the tinted light can be thrown, as with indirect lighting from cornices, and by lighting the curtains and drapery at the front of the house.

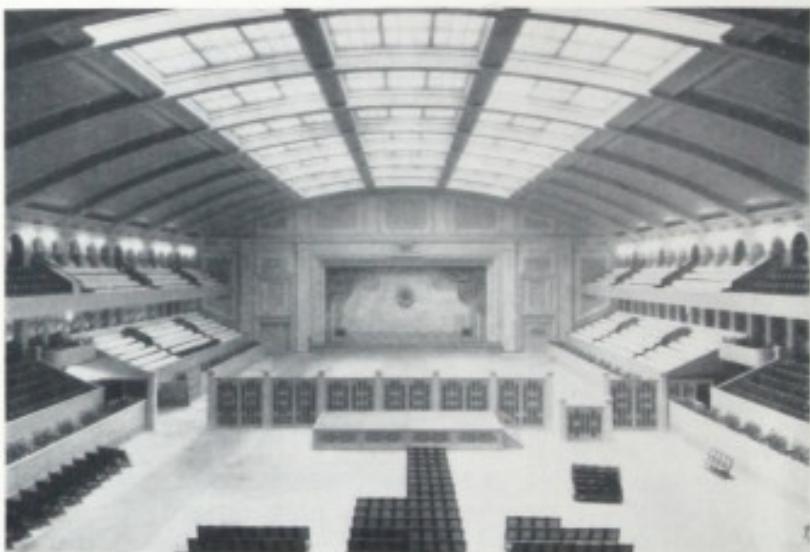
Another investigator whose work should be mentioned is Frederick Rimington, who many years ago gave much thought to the matter and developed a so-called color organ and wrote a book on color music. He, as well as Scriabine, attempted to make a scale of the colors with small success. All such attempts are doomed to failure on account of fundamental differences. We can combine two or more notes and get a chord of music which can be analyzed by the ear, whereas a combination of two or more colors results in a third color which cannot be analyzed by the eye into its components. As far as can be learned, Rimington used color in the abstract rather than by combining it with music.

A Philadelphia pianist, Mary Hallock Greenwalt, has also investigated the subject. In her work she overcomes many of the defects the others have encountered. While

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playing a number at the piano she floods the room with colored light in harmony with the mood of the composition.

A young Danish experimenter, Thomas Wilfried, has perfected a most ingenious instrument which he calls a Clivilux. He projects colors and colored figures of constantly varying shape on a relatively large screen. By means of an especially well arranged control box, he is able to manipulate his effects with the utmost finesse and produce some truly remarkable color pictures. He plays his own compositions on this instrument. Sometimes he uses the Clivilux in conjunction with organ or other music and a very satisfying result is secured.



The large skylight usually has ample room above for color lighting equipment which, if intelligently used, will add materially to the effectiveness of musical programs.

Physical Relations of Sound and Light

Light is similar to sound (music) in more ways than most of us realize. One is received by the eye, and the other by the ear and then conveyed by nerves to our brain where we get the impression.

Light is produced by vibration in the so-called ether; sound by vibrations of the air. With sound, a deep tone is the result of a slowly moving wave or vibration, a high pitch results from a much quicker movement of the wave. In light, there is a range from the lower frequency red to the more rapid violet waves.

An analysis of a sound shows the wave to have three characteristics—frequency or vibrations per second giving the pitch, amplitude or size of the wave on which function the volume (softness or loudness) depends, and finally the shape of the wave giving the quality or character of the sound. For example, a musical instrument and the human voice may emit the same tone with the same volume, but we can readily recognize the difference in quality.

With light the color, or hue, is a function of the frequency. The volume is represented by the intensity, while the mixture of white light with the fundamental color determines its purity or what is called the "saturation."

Both sound and light are capable of causing sensations of pain or pleasure, either by association or as the result of a direct effect from the inherent quality of the light or sound. A shrill, piercing whistling or a heavy crash may actually give physical pain for a moment and possibly, if violent, produce a permanent injury. A glaring brilliant

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Thomas Wilfried, who devised the Clavilux, is responsible for the coordination of the lighting in the Sherman's Bal Tabarin in Chicago.

Together with coordinating color and music, he has introduced a third element, that of a changing panorama, making a display that holds the patrons spell-bound throughout the evening.

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The changes in the panorama on the side walls are made possible through the use of twenty-two projectors located above the suspended ceiling; fifteen on the first level and seven on the second.

During the regular evening's entertainment approximately half the machines are in operation at one time.

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light source may hurt our eyes, and prolonged exposure to it may actually injure the mechanism of the eye.

Due to the similar characteristics of light and sound, some experimenters, such as Scriabine and Rimington, mentioned before, have made the mistake of believing in a direct relationship. We have a so-called octave of sound, c, d, e, f, g, a, b, c, and what may be called an octave of light, red, orange, yellow, green, blue, indigo, and violet, with half-tones represented by yellow green, green blue, etc. Certain people have attempted to assign tonal values to the colors of the spectrum just as though they were to play a scale in colors or write a score for color as they would for sound.

As a somewhat exaggerated illustration of the point we are trying to bring out, an experimenter might try to write a color score for *America* "My Country, 'Tis of Thee." His music would read, c, c, d, b, c, d, e, e, etc., his light score might read yellow, yellow, green, orange, yellow, green, blue, blue, etc.

It is obvious that attempting to follow any such practice as this would lead us nowhere and that we would have a meaningless, unintelligible result. We must have our tie-in between the two senses—hearing and sight—based on the psychological or association element. Realizing this, it is evident that rather than an individual note having a corresponding color to accompany it, a group of notes that is a motif or theme of the composition, or even a whole section, will have a much more definitely associated color.

Psychological Relations of Sound and Light

We must give consideration to the manner in which light will affect our emotions. We are stirred at the sound of the military band, the soft soothing strains of *Traumerei* or Kamennoi-Ostrow rest us and quiet the nerves, while the modern jazz tune has still another effect. Some of us experience the whole gamut of human emotions, listening to the wonderfully descriptive music of Massenet, Puccini, or Wagner. Particular phrases promote sorrow or joy, depress or exuberate us. Light has a similar effect, the colorings of nature as expressed in sunrise or sunset give one a thrill, the cool, restful green of the wood has its effect, while the changing blues of the sea also produce another impression.

It is obvious that there is a definite psychological connection between music and color. Everyone will agree that certain music is exciting, other music quieting, and that still another melody may actually sadden or depress us. It has been proven very definitely that, in general, red is exciting, yellow stimulating and buoyant, green quieting and soothing, while blues and violets are depressing, subduing, and saddening in nature. Therefore, all we have to do is to analyze a musical composition and determine whether as a whole it is exciting, quieting, or stimulating, and accompany it with the color of light which gives the same reaction. Any good composition has a certain color setting in which it can be most effectively presented. A symphonic movement played in the proper setting will be much more enjoyable than the same movement played

under lighting which gives a different reaction. It is this very fact that makes a haphazard operation of the lighting so objectionable to those who are sensitive. If, for example, the orchestra is playing a martial Sousa number which tends to excite us and the electrician has turned on the blue light, we have two forces working within us producing quite opposite effects. Similarly, if the orchestra is playing a quieting, pastoral bit and the house is brilliantly illuminated in yellow, again we have opposing forces at work.

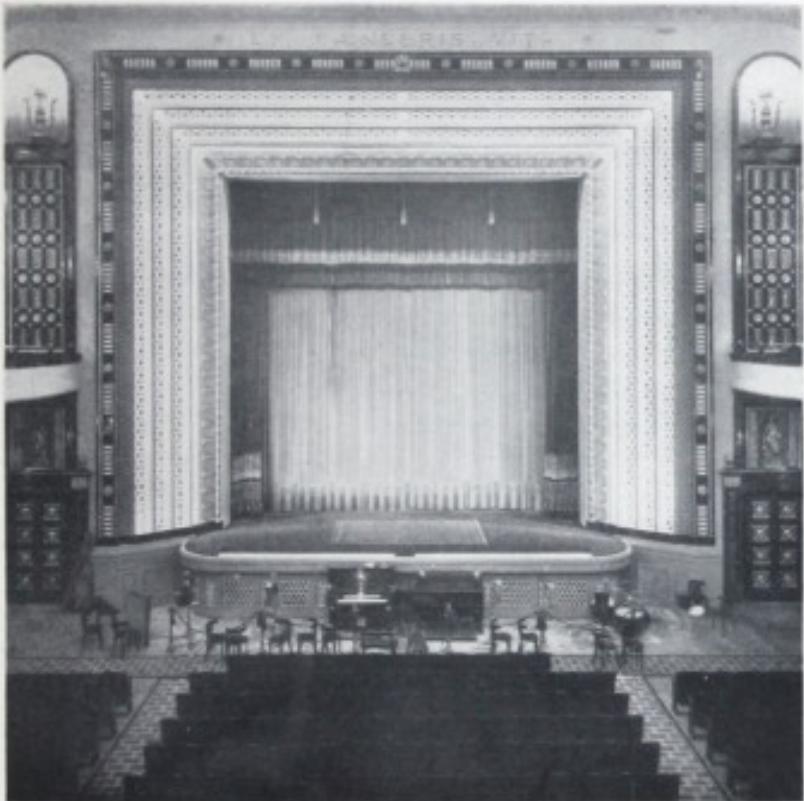
Association Value of Color

Besides this purely psychological effect of color, there is another action which we might term association. Certain music of the so-called program or descriptive type paints in our imagination a perfectly definite picture, and it is logical to accompany various parts of this constantly changing picture with color that suggests the same thing. Through the ages we have come to associate color with certain attributes. For example: red with fire, danger, war, courage, passion, etc.; yellow with gaiety, festivity and revel, youth, action, warmth, glory; blue with the moonlight, the sea, the sky, truth, fidelity, loyalty; green with the wood, the meadow, youth, spring, hope; white with peace, purity, modesty; pink with beauty, love, health, and so on.

The man who writes the color score for the music must be somewhat of a pioneer as well as an artist. He must know the music, and the story the music is telling. He must then see what particular color, or combination of colors, and intensity should be visible at each instant. He must

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be listening to the music as he manipulates his switches and dimmers in order to catch each change of spirit or musical cue. It is even possible that he may vary his use of light depending on his mood at the time. These are features which give the problem such a fascination.



View of the Odeon Cinema Theatre in Milan, Italy, where color music programs are a feature. The curtain, proscenium arch, and side wall niches are all made luminous.

Application of Color Lighting with Music

There are certain descriptive numbers which are particularly susceptible to color treatment, for example, Wagner's *Ride of the Valkyries*, Siegfried's *Funeral March*, *Good Friday Spell*, Tschaikowsky's *Marche Slav*, *Overture 1812*, Rimsky-Korsakow's *Scherazade*, *Sadko*, Rachmaninoff's *Island of the Dead*, Rossinnin's *Overture William Tell*, Von Suppe's *Overtures*, and so on.

The numerous themes offer great possibilities for changing colors. Flashes of one color can be superimposed on another. A shrill, piercing note can be accentuated by a brilliant light momentarily exposed. At times, the change from one color to another will take place gradually, at other parts abruptly.

With a crescendo passage the intensity will naturally increase with the volume of sound. During moments of pianissimo it is logical that low values of lighting should be used. As the music rises and falls the illumination follows its every movement.

A color "chord" can be produced by shooting shafts of light adjacent to each other, rather than blending the lights together. As mentioned above, when one color is thrown on top of another one the effect is that of a third color which the eye cannot analyze. If the colors are side by side one will get the impression which it is desired to create.

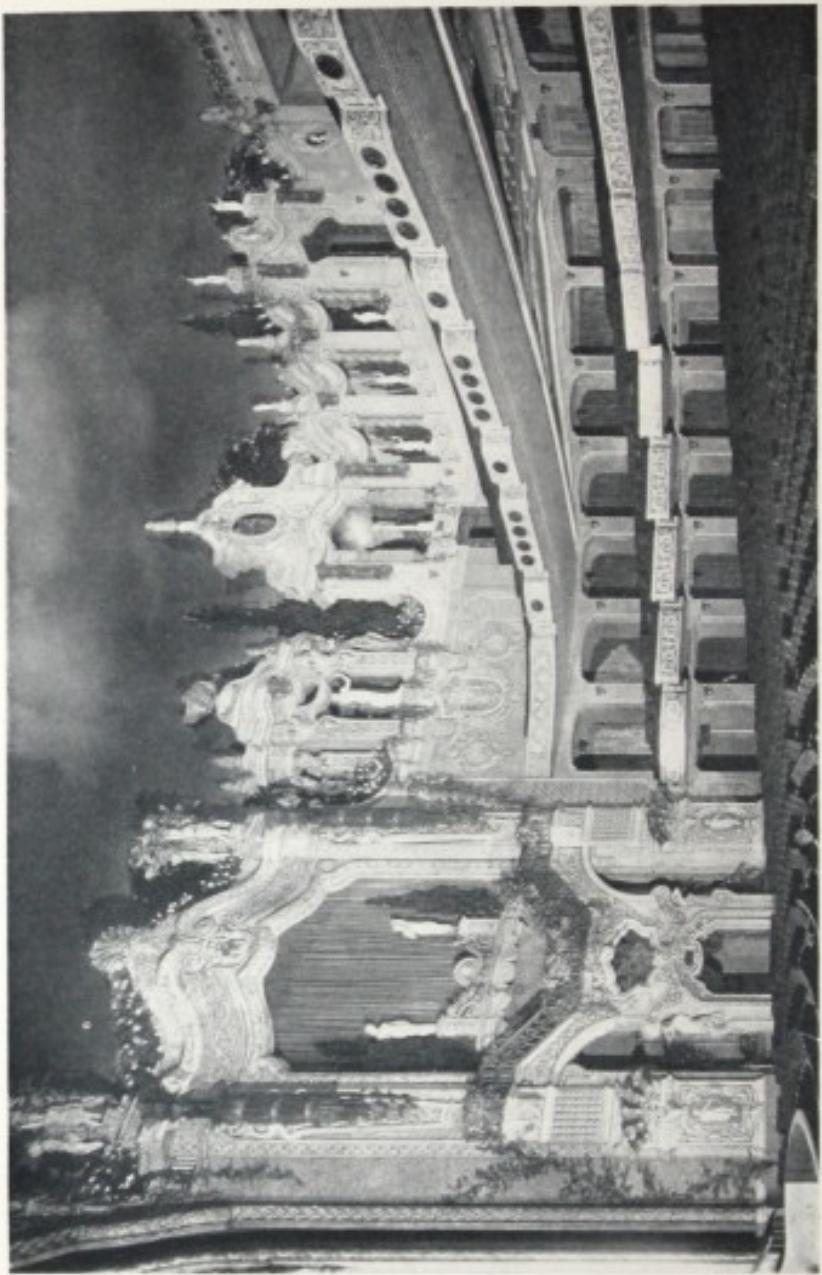
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If a curtain is to be illuminated, then lights can be located above, on the two sides, and below. The curtain can be made to assume one tint at the top and a different tone at the bottom in the case where it is desired to produce two reactions simultaneously, for instance, when two themes are being played, one by the strings, the other by the woodwinds. As one theme gradually overpowers the other (illustrated by the Pilgrims March drowning out the Venusberg motive in the *Overture to Tannhauser*) the color assigned to the second is gradually increased in intensity while that assigned to the first motive is gradually dimmed.

Probably each individual's conception of the particular color to be associated with a definite theme will not be the same, just as we all do not interpret a musical composition in exactly the same spirit. Nevertheless, there are bound to be certain well-established impressions.

We have often tried the experiment, after explaining the fundamental theory to some musician, of having this man use the equipment in the G. E. Lighting Institute and give his own interpretation of a particular number. It is remarkable to note how easily reproducible the coordination becomes. Two individuals who have never seen each other light a given number, by keeping in mind the fundamental principles will give as nearly the same interpretation as two pianists would give of the same composition. There are slight differences, due to natural individual or personal impressions, but in general, the main parts are quite identical.

The atmospheric theatre presents unusual possibilities for the use of color in connection with the music renditions. Carefully planned programs are necessary if the effects are to be fully appreciated.



Color Cue Sheets or Color Scores

Music cue sheets on typical numbers might be as follows:
Rheingold—“*Entrance of the Gods into Wallahalla*”—*Wagner*

Wotan and the other Gods stand contemplating the beautiful golden castle, Wallahalla, that the giants have built for them. It is far across the valley and they have no means of entrance. Donner causes a storm to come up (Incantation of the Thunder motive) which soon subsides, leaving a dazzling rainbow bridge (the Rainbow motive) to the castle (Wallahalla motive). As the Gods pass over this mystic bridge we hear from the music that Wotan is thinking of the ring (Ring motive) which was stolen from the Rhine (Rhine motive). The “Rhine Daughters” are heard bewailing the loss of their “gold.” Wotan realizes that he must create some powerful means to defend the Gods and we hear for the first time in the music drama a very important motive “The Sword of the Gods.” As the curtain goes down the group enters Wallahalla and a brilliant return of the rainbow motive accompanies them with the Wallahalla motive in counterpoint.

It would seem that the following lighting is quite appropriate:

“Incantation of the Thunder”—low intensity of blue with flashes of yellow at the proper time symbolizing the lightning.

“The Rainbow”—Shafts of red, green, and blue light from the top, streaking across the curtain giving the effect of the spectrum.

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"Wallahalla"—Yellow from above, red from below.

"The Ring"—Yellow top and bottom.

"The Rhine"—Blue top, green bottom, rising and falling in intensity.

"The Rhine Maidens"—shafts of green from top.

"Gold"—Shafts of yellow on the blue background.

"The Sword of the Gods"—Brilliant red of high intensity top and bottom.

Finally Rainbow at top changing to all up full brightness.



In this public auditorium, color lighting equipments above the skylight and in the coves make it possible to supplement the organ or orchestra program with one of color and motion.

"*Overture 1812*"—Tschaikowsky

As everyone knows, this music portrays the events which took place during the Napoleonic campaign of 1812, when fresh from their other victories, the French forces subjected Moscow to a severe bombardment, taking the citadel of the city. During the night the Russians set fire to the town, rose to arms and succeeded in driving Napoleon from the scene.

The descriptive music opens with peace resting over the city of Moscow. The usual color accompaniment of the sunset seems appropriate, changing into the blue green of moonlight. As night comes on the people retire to their homes after having sung the Russian hymn *God Preserve Thy People*. Here a somewhat low intensity of yellow might symbolize the lighting in the open squares during the community chorus, fading into a low intensity of blue as the song ends. The spirit of the music suddenly changes and the French troops are heard approaching with snatches of the Marseillaise and the booming of cannon. Here the semi-darkness is broken by flashes of yellow as would result from the distant cannon. The music grows more and more furious, the drums beat and the trumpets blare. The curtain gradually becomes red with more vivid flashes of yellow. Then, as the city burns, the red becomes more and more intense, gradually dying out as the battle terminates. The sky clears again and we return to the blue green of the moonlight. As the French retire we hear the Russian anthem *God Save Our Czar*, and as the music swells to a glorious finale the intensity of light rises and rises till at the very end the scene is flooded with a pure white light of maximum value.

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Overture "Tannhäuser"

Pilgrims Chorus—Deep blue rising in value as motive becomes more pronounced.

Venusberg motive—Pinkish lavender from below washing out the blue for the Pilgrims Chorus as the music overpowers the latter.

Hymn to Venus—Brilliant red.

Elizabeth motive—Vertical shafts of white on the colored background.

At the end reverse procedure of opening harmonizing with the predominance of the "leit motifs" ending with brilliant blue touched with pure white.

Selling the Idea to the Public

It is recognized that the public as yet does not have a universal appreciation of the possibilities of the combination of color and music, and the motion picture house can do a remarkable educational work. It is suggested that in the program be printed a brief outline of the fundamental principles on which this coordination is based. This should be followed by a brief description of the musical numbers which are to be played, accompanied by color. And, finally, a synopsis of the colors which will be used with the various themes, motives, or section, such as outlined above. In this manner the audience will become interested in the undertaking, will appreciate the music, will enjoy the effect, and the theatre will build up a reputation for novelty and progressiveness.

